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## INSECT PESTS OF TEA IN NORTH-EAST INDIA DURING THE SEASON 1916.

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A noticeable feature of insect attack in the tea districts of North-East India during the season 1916 was, that while *Helopeltis theivora*, the tea mosquito, though severe, was not more than usually so, and in some cases less so, in districts which suffer from its depredations year after year, it appeared in increased numbers in districts which have usually been considered to be fairly free from attack. This happened, not in one isolated district, but in different and widely separated districts in the areas under tea, the three districts affected being the Eastern Duars, part of the Balisera district (to a less extent) and parts of the Sibsaigar district (to a still less extent.)

Another feature was the unusual severity of greenfly attack in the Central Duars, following, in most cases, severe hail.

### THE TEA MOSQUITO.

(*Helopeltis theivora*.—Waterh.)

ASSAM.—This pest is reported from the North Bank of the river from the Bishnath district, where it appears to have been about the same as last year, with local fluctuations mostly for the worse. The pest was noticeable on the tea from the end of July or the beginning of August to the end of the season, though in one place it first appeared in June, and the attack was at its height in July and August. In the Mangaldai district the tea mosquito is never a pest and the report from that district makes no mention of the insect. When the Entomologist was in that district in December, however, he noticed a patch of old tea, of about an acre in extent, in a garden close to the hills, which appeared to be suffering severely from mosquito blight. Investigation showed that the damage was not due to *Helopeltis*, but to the capsid bug *Disphinctus humeralis*, and it is worthy of record that, while the attack was extremely local, the bushes affected suffered serious

damage identical in all respects with that caused by *Helopeltis*. Reports were not received from the North Lakhimpur or Tezpur districts.

On the South Bank of the river the tea mosquito was not mentioned as an active pest in the reports received, which were from the Lakhimpur and Jorhat districts, but during the season reports were received that it was becoming increasingly active in the Sonari district and in certain parts of the Jorhat district. In the Golaghat district the attack was similar to that in the previous year.

CACHAR AND SYLHET.—In the Happy Valley this pest was worse than last year more especially in the East end of the district, while it was extremely bad in the Hailakandi district. In the Longai-Chargola district the damage, though serious and affecting some 50 per cent of the total acreage, was hardly so bad as last year, and there was a tendency for the blight to lift in November. An important development in this area, however, was the increase in the damage done on certain gardens in the Balisera Valley.

DARJEELING-TERAI.—The reports from these districts indicate that the severity of the attack was less than last year in the higher level gardens, but similar to last year in the lower level gardens.

DUARS.—In the Western Duars this pest appears to have held off a little longer than usual, but came down badly later in the season. In the districts further East, however, the attacks were much more severe than usual, and in the extreme Eastern districts the pest appeared in sufficient numbers to make it evident that it has at last gained a foothold there, one or two gardens suffering severely.

#### GREEN FLY.

##### *Empoasca flavescens*.—Fab.

ASSAM.—On the North Bank green fly was again in evidence, being slight in some places, moderately serious in others, the worst months being June and July. There was less than usual in Upper Assam, while moderately bad attacks were experienced in parts of the Sibsagar district.

CACHAR AND SYLHET.—No mention of green fly occurs in the reports from these districts.

**DARJEELING-TERAI.**—In Darjeeling attacks of green fly were slight, and less than last year. May and June were the worst months, but in some places the attack continued into August. This pest does not appear to have attracted attention in the Terai.

**DUARS.**—Green fly was particularly bad in the Nagrakata and Dina Toorsa districts, following hail, and reaching its climax in May and June. In other parts of this area the attacks were slight only.

#### RED SPIDER.

(*Tetranychus bioculatus*.—W.-M.)

**ASSAM.**—Along the North Bank this pest was, on the whole, less serious than in the previous year, and the reports from districts on the South Bank indicate a similar state of affairs.

**CACHAR AND SYLHET.**—No reports of serious attack, such as were experienced in some places during 1915, were received from these districts, and red spider, though general, appears not to have been particularly serious in the area as a whole.

**DARJEELING-TERAI.**—In Darjeeling this pest was not quite so serious as usual, and was worst in May. At the lower elevations of the Terai the pest was earlier in evidence, and at its worst in April-May, but does not appear to have been particularly serious.

**DUARS.**—Here the attack was much as usual, if anything less than last year. In many places, in addition to the usual attack in the early part of the season, the pest was also in evidence in October, November, and December.

#### RED SLUG.

(*Heterusia magnifica*.—Butl.)

**ASSAM.**—At one place in the Bishnath district this pest was serious during 1916, and persisted through the year, but at other places on the North Bank the damage done was negligible. No mention is made of its occurrence on the South Bank.

**CACHAR AND SYLHET.**—There is no mention of the occurrence of the pest in these districts.

**DARJEELING-TERAI.**—No mention of Red Slug.



DUARS.—Red slug is again reported from the Chulsa district, but in even smaller numbers than last year.

#### LOOPER.

(*Biston suppressaria*.—Guen.)

ASSAM.—This pest is again reported from the North Bank only, but in much smaller numbers than in 1915. The autumn brood was again the one which did most damage.

#### FAGGOT AND BAG WORMS.

(*Clania spp.*).

ASSAM.—Slight damage by these pests over restricted areas is reported from districts both on the North and South Banks.

CACHAR AND SYLHET.—No damage reported.

DARJEELING-TERAI.—No damage reported.

DUARS.—A slight occurrence of these pests is reported in the Chulsa district.

#### NETTLE GRUBS.

(*Thosea spp.*)

ASSAM.—Local attacks of these pests occurred in parts of the Dibrugarh district, during the latter half of the season, and in one case the attack is reported as serious.

CACHAR AND SYLHET.—No damage reported.

DARJEELING-TERAI.—No damage reported.

DUARS.—In the Chulsa district a slight attack of these pests occurred in the early part of the season, the caterpillars being less in evidence than in 1915.

#### THRIPS.

(*Physothrips setiventris*.—Bagn. and an undescribed species.)

DARJEELING.—This pest was again serious in the Darjeeling district, the attack being of normal intensity, though slightly less at some places and slightly worse at others. The insects were in evidence from April to October, and at their worst in May and June.

## CRICKETS.

(*Brachytrypes achatinus*.—Stoll.)

ASSAM.—Damage by these insects in nurseries is reported from both banks of the Brahmaputra.

## TERMITES.

(*Termes (Odontotermes) sp.*).

SYLHET.—These pests are reported as serious in the Balisera Valley.

Other pests reported as having occurred are :—

“BORERS”—in the Duars.

CLUSTER CATERPILLAR (*Andraca bipunctata* Wlk.) in the Jorhat district.

TEA SEED BUG (*Poecilocoris latus* Dall.) in Bishnath and the Duars.

*Carteria decorella* Mask,—a scale insect received from the Chulsa district of the Duars.

## BLACK ROT DISEASE OF TEA.

### *Hypochnus theae.*

A similar disease to that which has been given the name of Black Rot in Ceylon occurs in the tea districts of North-East India. The writer has observed it on tea in damp shady situations round the edges of bheels and flats in Cachar. It has also been seen in damp jungly corners in the Terai and at the lower elevations of Darjeeling gardens. It does not appear to be common. The removal of excessive shade and the clearing away of the jungle seems to be all that is necessary to keep it in check.

The fungus causing the disease is a species of *Hypochnus* but appears to differ in some details from the Ceylon species. No inoculations on tea have been tried in North-East India though strangely enough some shoots, which were placed under glass covers ready for inoculation with another fungus, developed this disease. The fungus grew from the leaves to the glass sides of the vessel producing its fructifications on the latter. As this disease appears to be capable of doing considerable damage under favourable conditions the leaflet of the Ceylon Department of Agriculture is reproduced in full below.

“A new disease of tea has recently appeared in two districts in the low country. In its effect on the bush, as far as it is evident to the planter, it may be regarded as a leaf disease, but the fungus which causes it is not confined to the leaves, and attempts to eradicate it by gathering and burning diseased leaves, can only result in failure.

Attention is usually drawn to the affected bushes by the blackening of the young leaves. The more tender leaves at the tops of the shoots turn black, soft, and rotten. This resembles, to some extent, an attack of Grey Blight or Brown Blight on the flush, though the diseased leaves are usually softer than in the case of these two diseases and do not show the distortions which so

often accompany them when they attack young leaf. It differs, however, from Grey and Brown Blight in the following particulars.

(1) Many of the affected leaves, although completely black and rotten, do not fall off, but remain hanging to the twigs. If such leaves are carefully removed from the branch it will be found that the leaf stalk is fastened to the branch by a very thin film of threads, or mycelium.

(2) If a diseased leaf comes in contact with another leaf, healthy diseased, or with the stem, it becomes united to it by a web of fungus threads.

The chief characteristics of the disease are (1) the persistence of hanging dead leaves, and (2) the occurrence of dead leaves united in clusters of two or three, or united to the stem by mycelium.

The fungus which causes the disease consists of very fine threads which run along the stems and over the undersurface of the leaves, giving off branches which penetrate into the living tissues of the tea bush and kill them. It has been found on woody stems up to an inch in diameter, and can no doubt occur on any part of the bush above the ground. On the old stems it does not appear to cause any damage. Younger woody stems, about one-third of an inch in diameter, may show a number of small corky warts, but these may apparently result from other causes also, and are not an infallible sign of this disease. On the green stems, the fungus causes a premature hardening in the form of scaly grey brown patches. It is not until it reaches the leaf that any serious damage can be noted.

The first sign of an attack on the young leaf is the appearance of a number of small blackish-brown or chocolate-brown spots, usually crowded together. The upper surface of the leaf appears sunken on and round the spots. The spots soon run into one another and form a patch which gradually extends over the whole leaf. Large patches are red-brown to chocolate-brown, usually mottled, becoming black when old and wet.

On older leaves, the effect may not be so general, only part of the leaf being attacked, but this no doubt depends on the weather. If the whole leaf is not involved, the diseased spots are usually

large, sunken, black, or deep chocolate-brown with a blackish margin, uniformly coloured or mottled, on the upper surface, and greyish-brown, somewhat sodden on the lower. When dry, the spot is grey, and may easily be mistaken for Grey Blight.

The fungus threads run along the stem and pass to the leaves *via* the leaf stalk. As far as has been determined, they are confined to the under surface of the leaf, except in cases where a diseased leaf falls on the upper side of a sound one. But even in the latter case the fungus does not appear to penetrate into the sound leaf through the upper surface. The spots may first appear at any point on the leaf, not necessarily at the stalk end as might be expected. Frequently, the fungus accumulates in the axil of the leaf, (*i. e.* the angle between the leaf and the stem) and forms a fairly dense, white or yellowish felted cushion, while the leaf and stem are still green.

In addition to the attack on the leaf *via* the leaf stalk, healthy leaves, may be infected by coming in contact with diseased leaves or from diseased leaves, which fall off and adhere to those below. As far as has been observed, the fungus does not produce aerial mycelium, *i. e.*, free threads which stretch across from one leaf to another, as in the case of Horse hair Blight.

Except when it forms cushions in the axils of the leaves, the fungus, to a great extent external, is invisible to the naked eye and can scarcely be detected with a hand lens.

The easiest way of detecting the fungus of "Black Rot" is to remove a diseased leaf, preferably one which is completely black and rotten, very carefully from the branch. A thin film of mycelium will then be found running from the leaf to the stem, and this can sometimes be peeled off the stem for a short distance. If a shoot which bears one or two diseased leaves be placed in a closed tin box, it will be found, in about twelve hours, to have produced a quantity of greyish\* cobwebby mycelium. The growth of the fungus under such circumstances is extraordinarily rapid, and glass dishes in which diseased shoots are enclosed are usually filled with masses of mycelium in a few days. This indicates the possibility of a very rapid spread of the disease under suitable weather conditions, *e. g.*, a saturated atmosphere and a high temperature.

## OCCURRENCE OF THE DISEASE.

The disease usually occurs in patches, scattered over the field. This would indicate an original distribution by spores, blown to different parts of the field, and a subsequent spread at each point by the growth of the mycelium and the dispersal of diseased leaves. There is every reason to believe that the fungus is an inhabitant of the Ceylon jungle and spreads from the jungle to the tea. On the infected estate, it has been found on an isolated group of jungle shrubs, on Gurukina (*Calophyllum Burmanni*) of which the clump was chiefly composed, and on Iramusu (*Hemidesmus indicus*), a climber which overran the Gurukina. There would not appear, however, to be much probability that it will prove to be confined to any particular shrub.

## IDENTIFICATION OF THE FUNGUS.

The spores of the fungus have not yet been observed. The fructification occurs on the under side of the tea leaf in the form of a thin, white, powdery patch. Up to the present, it has only been found in those older leaves which show little or no damage; it has not been seen on the completely blackened young leaf. The fructification shows that the fungus is a *Hypochnus* and we have adopted the name "Black Rot" for the disease because the same name is applied to a disease of coffee in Southern India which is caused by a species of *Hypochnus*. The Ceylon fungus, however, differs in several respects from the Southern Indian one, and is possibly a different species.

## INFECTION EXPERIMENTS.

Infection experiments on tea at Peradeniya have hitherto failed completely, though material was used on which the fungus was growing vigorously, and the attempts were made during the rains of the South-west Monsoon. It must not however be assumed that the fungus will not attack tea at Peradeniya or higher elevations: indeed, the history of plant pathology in Ceylon appears to indicate that species of *Hypochnus* will be found to be wide-spread parasites, though this one has not been reported on tea before.

## LENGTH OF LIFE OF THE FUNGUS.

The tea *Hypochnus* is still alive on prunings left in the field, two months, at least, after pruning. Prunings gathered in June from a field pruned in April yielded an abundance of mycelium when placed in closed glass dishes, which rapidly produced the characteristic spots on fresh tea leaves put in subsequently. In the same field, and at the same date, the lower branches of some bushes, whose new leaves had come into contact with the prunings on the ground, had already acquired the disease from the prunings.

## REMEDIAL MEASURES.

As the fungus lives on the stems and branches, diseased bushes must be pruned well back, and as it continues to live on the prunings if left on the ground, these must be removed and burnt. This procedure will get rid of the greater part of the fungus, but as it may still exist on the older stems, the pruned bushes must be well sprayed with Bordeaux mixture.

The following mixture has been recommended in recent years, in view of the quality of Ceylon lime, in the place of Standard Bordeaux-mixture.

Dissolve 6 lbs.  $6\frac{1}{2}$  ounces of copper sulphate in two or three gallons of water in a wooden vessel. Slack some good quicklime with a little water and put it into a tub with 120 gallons of soft water. The quantity of lime should be, in Ceylon, about 5 lbs. Stir up the lime and water two or three times and leave it to settle. Run off 86 gallons of the clear lime water, and mix it with the copper sulphate solution, and then make it up to 100 gallons by adding 11 or 12 gallons of soft water." T. Petch leaflet No. 2 Department of Agric., Ceylon.

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## A FEW NOTES ON BAMBOOS.

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Some time ago, in answer to an enquiry, information regarding bamboos was collected from various sources. As the question is one of general interest the following notes, which were for the most part compiled by the Department of Economic Botany, are now published.

The best soil for growing the larger kinds of bamboos is a sandy alluvial loam, if possible within easy reach of water.

The cultivation of bamboos in India is easy and thus very little is done towards manuring bamboos. But the practice is observed, during the period of rest, of applying the ashes obtained from fallen bamboo leaves and covering them with silt.

Germination by seed is sometimes tried with success but this is possible only in a very few cases. There are species which flower and produce seed at intervals of 40 to 50 years. Thus vegetative reproduction of bamboos is necessary. This is done by three distinct methods, *viz.*, by means of (a) layers, (b) offsets, and (c) cuttings.

(a) With the more common bamboos the general practice is by means of layers, which consist of a portion of the old stock with a culm of the year laid in the ground so that it begins to root at the nodes. When the shoots have appeared and are strong, the layer is cut at the internodes and the portions planted separately.

(b) Offsets consist usually of a portion of the old shoot with its shoots cut off above a joint at about 1 to 2 feet above the ground. The shoots come out from the dormant buds at the base of the culm. These offsets are best taken and planted in the period of rest.

(c) Cuttings are made by planting one or more internodes, the lowest bearing root buds capable of growing.

The following list gives the most common species in Assam :—

*Bambusa tulda*.—The Tulda Bans of Bengal and the Nal or Deo Bans of Assam. It is one of the most common



species in Lower Bengal and Assam with culms 20 to 70 feet in height and 2 to 4 inches thick. It is often cultivated.

*Bambusa nutans*.—The Mukial or Mokal in Assam. It grows in East Bengal and Assam and has bright green culms 20 to 40 feet in height and  $1\frac{1}{2}$  to 3 inches in diameter. It arises from long rhizomes rather far apart.

*Bambusa balcooa*.—The Baluka in Assam. It is a large, strong, tufted bamboo with greyish green culms 50 to 70 feet high and 3 to 6 inches in diameter.

*Bambusa vulgaris*.—The Bansini in Bengal (so called as it is held to be the female bamboo) and Bariala in Chittagong. This species is commonly cultivated throughout India. A large and handsome species with rather distant bright green culms reaching about 20 to 50 feet in height and 2 to 4 inches in diameter. The walls are comparatively thin.

*Bambusa arundinacea*.—The Behor or Ketua. Found throughout India and is a magnificent species at once recognised by its thorns and peculiar culm sheaths. The culms reach to about 100 feet in height and 6 to 7 inches in diameter.

*Oxytenanthera nigrociliata*.—The Kalia in Bengal from its black fringe-like hairs whence it derives its specific name. It grows in Bengal, Assam and elsewhere. It is a tufted bamboo with culms 30 to 40 feet in height and  $\frac{1}{2}$  to 2 inches in diameter. Used generally in basket work.

*Dendrocalamus strictus*.—The Male Bamboo called the Karail in Bengal. This bamboo, when it grows on dry places, has its culms quite solid though in moist and wet places a distinct cavity within the bamboo is observed. The culms grow to 30—50 feet in height with a diameter of 1 to 3 inches. The culms are glaucous when young but are yellowish with age.

*Dendrocalamus Hookeri*.—The Ussey, Assey denga or Ukamong in Assam. It is found from Sikkim eastwards

to Assam and Chittagong. A large bamboo with culms 50 to 60 feet high and 4 to 6 inches in diameter. The internodes are made into water buckets.

*Dendrocalamus Hamiltonii*.—The Kokwa in Assam. This is the common bamboo of Northern Bengal to Burma. The culms are up to 80 feet in height with a diameter of 4 to 7 inches white hairy when young but greyish green when old.

*Dendrocalamus giganteus*.—The Worra in Assam. It is the largest bamboo known in India. It is cultivated in Assam, as well as in many other parts of India. Culms reach 80 to 100 feet in height and 8 to 10 inches in diameter.

*Cephalostachyum pergracile*.—The Satang in Naga Hills. It is a small, deciduous arboreous bamboo very elegant in shape, with culms 30 to 40 feet in height and 2 to 3 inches in diameter but is rather thin walled, usually about  $\frac{1}{2}$  inch thick. In Assam it is used for basket work.

*Melocanna bambusoides*.—The Muli bans of Bengal or Terai in Assam. It is an evergreen arboreous bamboo with single distant culms rising from underground rhizomes. It is found in East Bengal to Burma but its real home is in Chittagong Hill Tracts whence 16 millions are annually imported into Bengal. It has a large fleshy fruit.

## AN EASILY GROWN FODDER CROP.

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A fodder crop which requires very little attention and yields a large crop when natural fodder is scarce would be a great boon in many tea districts. The plants most commonly used in the other parts of India are with few exceptions unsuited to the climate of the tea districts. One of the exceptions is Guinea grass (*Panicum maximum* jacq.). This is a tall perennial native of Africa. Some time ago a few small plots of this grass were planted from seed at Tocklai. At first they grew slowly but as soon as the young plants became established the growth was remarkable even on unmanured soil. The first cutting yielded 14½ tons per acre.

The plant has been used in India as a fodder for very many years. In 1876 it was grown in Coimbatore and the cuttings averaged 960 maunds per annum per acre. In a more recent report (Agricultural Journal of India Volume V. page 364, 1910) the weight of the cuttings are given as follows :—

						per acre.
" 1st year between 1st of Feb. and end of Nov.,	yield					4 tons.
" 2nd " " " " " "	7 cuttings					25 "
" 3rd " " " " " "	7 "					50 "
" 4th " " " " " "	7 "					65 "
" 5th " " " " " "	7 "					80 "
" 6th " " " " " "	7 "					100 "

It has excellent feeding value. In the above mentioned report it is stated that "for the past fifteen years twenty working bullocks, ten young bullocks, six milking cows, one dozen calves and two or three country ponies have had to live practically solely on guinea grass." It is estimated that one acre of Guinea grass is sufficient for 25 head of cattle. It is said to sometimes upset the digestion a little when first fed but the animals very soon get used to it. Details of the cultivation of this wonderful plant are quoted below from Mukerji's Handbook on Indian Agriculture page 503.



Guinea grass,  
(*Panicum polyanthemum* Jacq.)



“The land should be well drained, that water may not lodge in it even in the rainy season. If the plants are grown from seed, the land should be prepared when the rainy season is not quite over; but if they are grown from root-cuttings, the land should be cultivated in March or April soon after the winter crop has been harvested, irrigation being done, if necessary, to soften the soil for convenience of cultivation. After ploughing, the land should be cleaned of weeds and straw by passing a ladder or harrow over it. Before June the land should be got thoroughly clean and ready by seven or eight ploughings followed by as many ladderings or harrowings. Manure should then be spread over the land and ploughed in, and as soon as the rains have commenced, the planting of stumps should begin. If the plants are grown from seed, a seed-bed is necessary. Holes should be made in the seed-bed and two seeds put in each hole in regular lines and the bed again levelled up. Two days after sowing, the beds should be watered and the watering should be continued every third day until the plants come up. After the plants have appeared, watering should be done every second day except when there is rain. When the plants are about nine inches high, they should be transplanted, leaf stalks being cut off. The field to which they are removed should be got ready in the meantime, ridges being put up three feet apart and the planting done in the ridges. If the stumps are planted, the planting should always be done on ridges three feet apart. If seven or eight stalks with roots are planted in each spot, they will form a fine big clump. The stalks of the stumps planted should stick out seven or eight inches above ground. The clumps occupy a wider and wider area as time goes on and as the plants get cut away. In extending the plantation, some of the shoots can be taken up with roots and roots planted, or after the shoots have been all cut away, the stumps can be dug up, leaving a quarter at each spot. Unless the stumps are thinned out either in one or in the other way, the shoots become hard and less palatable to horses and cattle. After every second cutting the land should be manured with 100 to 150 maunds of farmyard manure or tank earth or jhil earth per bigha ( $\frac{1}{3}$  of an acre) per annum. Solid and liquid excrements of horses, men, sheep and

goats have been found the best manure for guinea grass. After transplanting seedlings or root cuttings on the fields, watering should be done daily, unless there is rain, until the plants are well established. Afterwards in the dry season irrigation should be continued once a month. In the rainy season, of course, no irrigation is required. After the shoots are cut off, the land should be dug up at intervals between the plants, the weeds collected and destroyed, and manure spread over and ploughed in and the ridges formed again. The shoots should be cut off before they run to seed, that they may be gathered quite tender. If seed is wanted, the shoots should be allowed to mature, but clumps that are constantly cut, produce weak seeds that do not germinate. Any seed stalks showing smut should not be touched but burnt off with fire. The Guinea-grass is not known to suffer from any other malady."

Our own experience has proved that this plant is one of the simplest to grow. To continue to yield well it requires feeding well with nitrogenous manures. It will yield crops throughout the year if it gets sufficient water. The period during which the yield is lowest happens to occur just when the ryot's fields are open to grazing. The seed may be obtained from most first class seedsmen.

A. C. T.

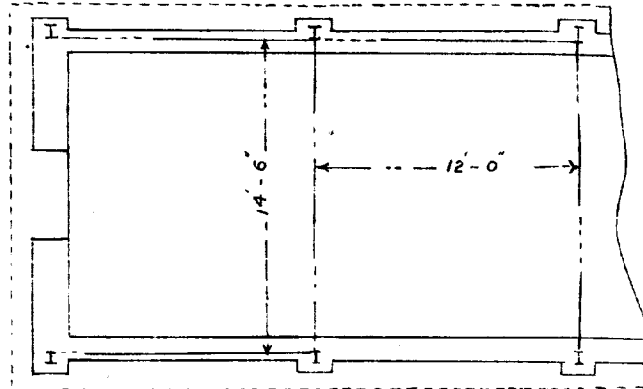




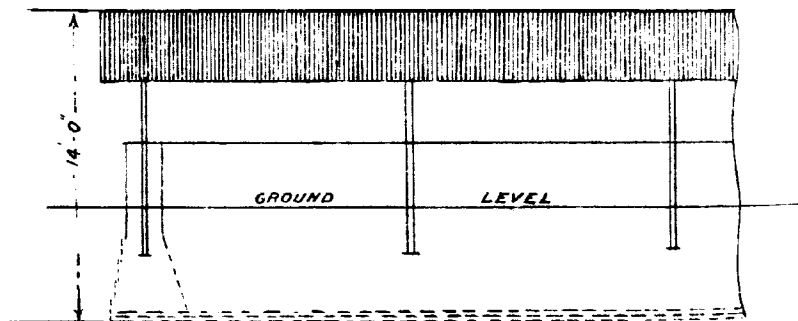
# MANURE SHED

SCALE 8 FEET = 1 INCH

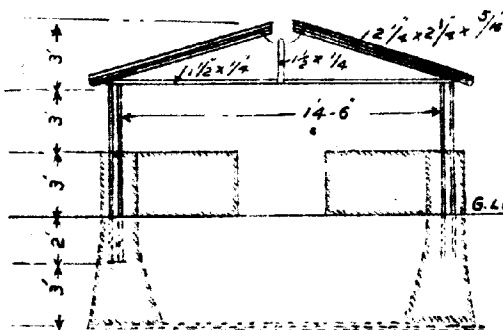
## PLAN



## ELEVATION



## CROSS SECTION



COLUMNS 6 x 3  
SHEETING 9'-0" 24 BWG  
TIE ROD FLAT IRON 1 1/2 x 1/4  
KING POST 1 1/2 x 1/4 F.I.  
PURLINS & LINES 2 x 2 x 1/4 L.I.

## NOTES.

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**The pruning of tea seed trees.**—A mistake in the note on pruning tea for seed in the last issue of this Journal has been pointed out. The experiment took place on the Koreakutia Tea Estate which is managed by D. Slimmon, Esq., who resides at Rungajan Tea Estate, Jorhat Tea Co. The seed is sold as Koreakutia not Rungajan seed. In continuation of the above mentioned note it may be mentioned that the bushes pruned to 7 feet have formed a remarkable quantity of seed which appears to be of larger size than that of the neighbouring unpruned trees. The thinning out and heading back of the young shoots were carried out in August.

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**Permanent manure pits.**—On most gardens organised attempts are made to collect line manure. It is remarkable, however, that in comparatively few cases is any attempt made to prevent losses of nutritious substances by the action of the weather. By careful storage not only may these losses be avoided but the value of the manure may be actually increased. A manure pit must be water-tight and protected from the weather. Where the soil is stiff and impervious to water, a pit dug in the ground and protected by a thatch roof is better than nothing; but in most places it is desirable to make it with pucca walls and floor. Some of the Calcutta Agency houses have adopted standard plans for pucca manure pits, and through the courtesy of Messrs. Octavius Steel & Co., we are permitted to publish one. It will be noticed that the wall is three feet high to keep the wind from unduly drying the manure. The opening all round the building is only three feet high, just enough to allow the collectors to throw the manure in from all sides. The pit is 14 feet 6 inches wide so that manure thrown in from all sides fills up the centre. An opening about 18 inches wide is made along the ridge to allow a certain amount of rain to enter, thus keeping the manure moist. In order to

facilitate consolidation of the manure the walls are given a slight slope inwards from top to bottom.

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**Prices of Manures.**—It is to be noted that since the publication of the first issue of this journal this year, the price of nearly all manures imported into India from abroad has risen considerably, particularly Nitrate of Soda. Sulphate of Ammonia has also gone up in price, this probably on account of increased demands from Ceylon and Java. It is satisfactory, however, that oilcakes still remain at a reasonable figure, and Sulphate and Nitrate of Potash remain much as they were, the latter providing potash at by far the cheaper rate even if Rs. 9 only be taken as the value of the unit of nitrogen. Basic Slag has gone up slightly in value and is still at a prohibitive price. Bone Dust is still likely to give by far the best results for money amongst phosphatic manures.

NOTE.—The letters *a*, *b* and *c* denote different suppliers.

MANURES.	PERCENTAGE COMPOSITION.			Price per ton.	UNIT PRICE.			REMARKS.
	N.	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O		N.	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	
NITROGENOUS MANURES— Nitrate of soda ...	(a) 15/16	...	...	Rs. As. P.	Rs. As. P.	Rs. As. P.	Rs. As. P.	
	(b) 15/16	...	...	(a) 300 0 0	(a) 20 0 0	...	...	
	(c) 15/16	...	...	(b) 320 0 0	(b) 21 5 4	...	...	
Sulphate of ammonia	(a) 20/21	...	...	(c) 375 0 0	(c) 25 0 0	...	...	
	(b) 20/21	...	...	(a) 400 0 0	(a) 20 0 0	...	...	
	(c) 20/21	...	...	(b) 350 0 0	(b) 17 8 0	...	...	
Nitrate of lime ...	N/4	...	...	(c) 375 0 0	(c) 18 12 0	...	...	
Calcium cyanamide ...	(a) 18	...	...	(a) 315 0 0	(a) 17 8 0	...	...	
Nitros ...	(a) 13/14	...	...	(a) 220 0 0	(a) 16 15 0	...	...	
Nitro-ammonia ...	(c) 18	...	...	(c) 330 0 0	(c) 18 5 4	...	...	
Dried blood ...	(c) 10	...	...	(c) 155 0 0	(c) 15 8 0	...	...	
Dried blood meal ...	(a) 11/12	...	...	(a) 180 0 0	(a) 16 5 3	...	...	
Rape cake ...	(c) 4/5	...	...	(c) 47 12 0	(c) 11 15 0	...	...	
Rape cake meal ...	(a) 4/5	...	...	(a) 47 12 0	(a) 11 15 0	...	...	
Castor cake ...	(c) 7/8	...	...	(c) 85 5 8	(c) 12 3 1	...	...	
Castor cake meal ...	(a) 5/6	...	...	(a) 71 11 0	(a) 11 5 5	...	...	

NOTE.—The letters *a*, *b* and *c* denote different suppliers—(continued.)

MANURES.	PERCENTAGE COMPOSITION.			Price per ton.	UNIT PRICE.			REMARKS.
	N.	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O		N.	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	
NITROGENOUS MANURES— (continued.) Groundnut cake ...	(c) 7.8	...	...	Rs. As. P. (c)	Rs. As. P. (c)	Rs. As. P. ...	Rs. As. P. ...	No price quoted.
Groundnut cake meal	(a) 6.7	...	...	(a) 61 7 3	(a) 10 3 10	...	...	
Standardised oilcake meal	(a) 4/7	...	...	(a) 41 to 63.12	(a) 9 1 8	...	...	
I. O. P. oilcake meal...	{ (b) 4½ (b) 5 (b) 5½	... ... ...	... ... ...	(b) 42 10 10 (b) 46 1 4 (b) 49 8 0	(b) 9 5 4 (b) 9 3 2 (b) 9 0 0	... ... ...	... ... ...	
POTASH MANURES— Sulphate of potash ...	...	...	{ (a) 25 (c) 25	(a) 200 0 0 (c) 200 0 0	... ...	... ...	(a) 8 0 0 (c) 8 0 0	Allowing Rs. 15 per unit of nitrogen.
Nitrate of potash ...	{ (a) 10 (c) 10 (b) 10	... ... ...	(a) 30.35 (c) 33 (b) 33.35	(a) 270 0 0 (c) 270 0 0 (b)	... ... ...	... ... ...	(a) 3 11 0 (c) 3 10 2 (b)	
	...	{ (a) 13 14 (c) 10 12	... ...	(a) 100 0 0 (c) 105 0 0	... ...	(a) 7 6 6 (c) 9 8 9	... ...	
PHOSPHATIC MANURES— Basic slag ...	...	...	...	...	...	...	...	

NOTE.—The letters a, b and c denote different suppliers—(continued.)

MANURES.	PERCENTAGE COMPOSITION.				Price per ton.	UNIT PRICE.			REMARKS.
	N.	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O			N.	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	
PHOSPHATIC MANURES— (continued.)					Rs. As. P.	Rs. As. P.	Rs. As. P.		
Superphosphate ...	...	$\begin{cases} (a) & 20\ 22 \\ (b) & 20\ 21 \\ (c) & 20\ 22 \end{cases}$	...	...	$\begin{cases} (a) & 115\ 0\ 0 \\ (b) & 115\ 0\ 0 \\ (c) & 130\ 0\ 0 \end{cases}$	$\begin{cases} (a) & 5\ 7\ 7 \\ (b) & 5\ 7\ 7 \\ (c) & 6\ 3\ 0 \end{cases}$	...		
Ephos basic phosphate	...	(b) 27	...	...	(l) 100 0 0	(b) 3 11 3	...		
Indofos basic phosphate	...	(b) 18	...	...	(b) 80 0 0	(b) 4 7 0	...		
Basic phosphate ...	...	(a) 14.15	...	...	(a) 100 0 0	(a) 6 14 4	...		
Phosphate of lime ...	...	(c) 11.12	...	...	(c) 110 0 0	(c) 9 9 0	...		
Flour phosphate ...	...	(c) 30/35	...	...	(a) 80 0 0	(a) 2 7 4	...		
BONE MANURES—									
Steamed bone meal ...	$\begin{cases} (a) & 3\frac{1}{2} \\ (c) & 3\frac{1}{2} \\ (b) & 4 \end{cases}$	$\begin{cases} (a) & 22\ 23 \\ (c) & 22 \\ (b) & 22\ 23 \end{cases}$	...	...	$\begin{cases} (a) & 75\ 0\ 0 \\ (c) & 75\ 0\ 0 \\ (b) & 70\ 0\ 0 \end{cases}$	$\begin{cases} (a) & 1\ 13\ 1 \\ (c) & 1\ 0\ 1 \\ (b) & 1\ 5\ 10 \end{cases}$	...	Allowing Rs. 10 per unit of nitrogen.	
Unsteamed bone meal	$\begin{cases} (a) & 3\frac{1}{2} \\ (b) & 4 \end{cases}$	$\begin{cases} (a) & 22\ 23 \\ (b) & 22\ 23 \end{cases}$	...	...	$\begin{cases} (a) & 70\ 0\ 0 \\ (b) & 62\ 0\ 0 \end{cases}$	$\begin{cases} (a) & 1\ 9\ 5 \\ (b) & 1\ 0\ 0 \end{cases}$	...		
Bone dust	$\begin{cases} (a) & 3 \\ (b) & 3 \\ (c) & 3 \end{cases}$	$\begin{cases} (a) & 20\ 21 \\ (b) & 18 \\ (c) & 22 \end{cases}$	...	...	$\begin{cases} (a) & 65\ 0\ 0 \\ (b) & 60\ 0\ 0 \\ (c) & 55\ 0\ 0 \end{cases}$	$\begin{cases} (a) & 1\ 12\ 0 \\ (b) & 1\ 10\ 8 \\ (c) & 1\ 2\ 3 \end{cases}$	...		

NOTE.—The letters a, b and c denote different suppliers—(continued.)

MANURES.	PERCENTAGE COMPOSITION.			Price per ton.	UNIT PRICE.			REMARKS.
	N.	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O		N.	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	
<b>GUANOS.</b>								
Dissolved Peruvian guano No. (1) ...	(c) 5	(c) 25	2	(c) 250 0 0	Rs. As. P.	Rs. As. P.	Rs. As. P.	} Allowing Rs. 15 per unit of nitrogen and Rs. 3-8 per unit of potash.
Dissolved Peruvian guano No. (2) ...	(c) 4	(c) 25	2	(c) 220 0 0	...	(c) 6 11 6	...	
Equalised Peruvian guano ...	(c) 8.9	(c) 4.5	5.6	(c) 210 0 0	(c) 20 2 0	...	...	} Allowing Rs. 2 per unit of phosphoric acid.
Sardine guano ...	(c) 5.7	(c) 10.12	...	(c) 130 0 0	(c) 18 0 0	...	...	
Milled fish guano ...	(c) 8	(c) 10	...	(c) 155 0 0	(c) 16 14 0	...	...	} Allowing Rs. 2 per unit of phosphoric acid.
Fish guano ...	{ (a) 7.8 (b) 7.8	{ (a) 9.10 (b) 9.10	...	{ (a) 160 0 0 (b) 150 0 0	{ (a) 18 10 6 (b) 17 5 3	...	...	
Fish sardine mixture ...	(a) 5.7	(a) 5.7	...	(a) 130 0 0	(a) 19 10 8	...	...	} Allowing Rs. 2 per unit of phosphoric acid and Rs. 3-8 per unit of potash.
<b>MEAT MANURES.</b>								
Sterilised animal meal (ordinary) ...	{ (a) 7.8 (c) 7.8	{ (a) 7.8 (c) 7.8	{ }	{ (a) 115 0 0 (c) 115 0 0	{ (c) 13 1 7 (c) 13 1 7	...	...	

NOTE.—The letters a, b and c denote different suppliers—(concluded.)

MANURES.	PERCENTAGE COMPOSITION.			Price per ton.	UNIT PRICE.			REMARKS.
	N.	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O		N.	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	
MEAT MANURES—(contd.)								
Sterilized animal meal (special) ...	{ (a) 7/8 (c) 7/8 }	(a) 7/8 (c) 7/8	2½ 2½	Rs. As. P. (a) 120 0 0 (c) 120 0 0	Rs. As. P. (a) 12 12 9 (c) 12 12 9	Rs. As. P. ... ...	Rs. As. P. ... ...	...
Sterilized animal meal (acne) ...	{ (a) 8½ (c) 8½ }	(a) 5 (c) 5	5 5	(a) 140 0 0 (c) 140 0 0	(a) 13 3 9 (c) 13 3 9	... ...	... ...	...
SPECIAL MANURES—								
Nervox ...	(a) 10	(a)	4	(a) 100 0 0	(a) 8 9 7	...	...	...
Ligox ...	(b) 10	(b)	4	(b) 100 0 0	(b) 8 9 7	...	...	...
Potanit ...	(a) 11	(a)	12	(a) 240 0 0	(a) 18 0 0	...	...	...
Sinox ...	(c) 10	(c) 10	...	...	(c)	...	...	...
Nitros ...	13/14	...	...	(c) 220 0 0	(c) 16 15 0	...	...	...
Nitro mixture, No. 1 ...	(a) 7½	2	7	(a) 132 8 0	(a) 13 10 10	...	...	...
" " 2 ...	(a) 8	3	7	(a) 140 0 0	(a) 13 11 0	...	...	...
" " 3 ...	(a) 8½	4	7	(a) 152 8 0	(a) 14 2 0	...	...	...
" " 4 ...	(a) 9	5	7	(a) 165 0 0	(a) 14 9 0	...	...	...

Allowing Rs. 3-8 per unit of potash and Rs. 2 per unit of phosphoric acid.

No price quoted.

Allowing Rs. 3-8 per unit of potash and Rs. 2 per unit of phosphoric acid.





